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PLASTIC CALKING MATERIALS

Plastic calking materials comprise a class of products which has, during recent years, aided materially in solving one of the inherent problems in the construction of masonry buildings. Although the sealing of joints between masonry and door or window frames constitutes a large part of the use of the plastics, there are numerous other similar purposes which they serve in building construction.

Being a comparatively recent addition to the list of building materials, there is much to be learned about the composition, fabrication, and control of the product for the varied service conditions to which it is exposed.

A few years ago the Bureau was confronted with the task of devising a means for determining the quality of such materials. The nature and uses of the product were such that the tests or equipment commonly used on other types of building materials were not applicable. New test procedures had to be developed and the necessary testing apparatus designed.

Four types of tests are now used and are intended to determine qualities

having a bearing on service performance. They have been in use for 4 years and a large number of samples have been tested for Government jobs. The "strain test" determines if the material remains sufficiently plastic in a joint to accommodate itself to structural movements which vary with the width of the joint; "staining tests" determine if the plastics discolor masonry near the joint and also give information on the performance of the material; "slump tests" determine if the materials will become too soft in summer and flow out of the joints; and "copper corrosion tests" are supposed to indicate certain undesirable properties of the plasticizing ingredients.

A detailed description of the various tests and the laboratory equipment was presented at the June meeting of the American Society for Testing Materials.

HIGH-EARLY-STRENGTH CEMENTS

Tests have recently been completed at the Bureau on a number of commercial high-early-strength portland cements. Concretes made from the cements with different amounts of water

were stored under various temperature conditions during the first 24 hours after making and under various temperature and moisture conditions afterward. Samples of concrete were subjected to treatments simulating weather conditions, such as freezing and thawing, and drying and soaking. Mortars of various types were also studied and their strengths compared with those of concretes containing different amounts of water.

All of the cements gave early strengths higher than those of ordinary portland cements. It was found that temperatures higher than normal 21° C. (70° F.) and up to 43° C. (110° F.) greatly increased the early strengths (up to 3 days) of the concretes. Later strengths depended on the cement and on the presence of moisture; the samples kept wet gave the highest strengths. Three hundred alternations of freezing and thawing somewhat decreased the strengths. Freezing and thawing combined with drying and soaking affected some of the concretes and mortars so as to cause spalling after about 100 freezings and thawings and about 30 dryings at 65° C. (150° F.) to such an extent that the concrete was no longer serviceable.

Mortars and concretes containing the same ratio of cement to water were approximately equal in strength at early ages. At later ages the mortar specimens tended to give higher strengths than the concrete.

The heat evolved by the cements was measured by storing concrete cylinders made from them in an adiabatic calorimeter—i. e., an instrument which did not allow any of the heat to escape. The rise in temperature of the concrete was used as a basis for calculation of the heat evolved, which varied from 104 to 130 cal/g of cement, after 90 days' storage in the calorimeter.

A more complete description of this work will be published as RP799 in the June number of the Journal of Research.

EXTRUSION MACHINES FOR HOLLOW CLAY WARE

In the formation of hollow clay tile by extruding continuous bars or columns of clay through dies, the quality of the product and the performance of the extrusion machine are affected by the design of the auger, spacer, and die. RP798 in the June number of the Journal of Research describes a study of the performance of a union type auger machine using augers with single, double, and triple wings in different

combinations with 10-, 15-, and 20-inch spacers, dies of 4-, 5-, and 6-inch lengths, and die tapers of 0, 2, 3, 4, and 6 degrees. The effect of different combinations of auger, spacer, and die upon the density of the plastic clay was also noted.

The single-wing auger proved the most efficient in point of power consumption and rate of extrusion. The minimum length of both spacer and die consistent with satisfactory quality of product was found to result in lowest power consumption. A die of 3° taper proved to be the most efficient with any combination of auger and spacer, resulting in maximum rate of extrusion and lowest power consumption per unit weight of clay extruded.

The density of the extruded clay column was not affected by changes in auger, spacer, or die.

ADVISORY COMMITTEE ON REFRACTORIES

There has been organized recently an Industrial Advisory Committee on Refractories to the National Bureau of Standards. The committee representatives were appointed from 8 companies manufacturing refractories and 1 from the Refractories Fellowship at Mellon Institute. The function of this committee is twofold, namely: (1) to keep the members of the refractories industry in close contact with current research studies and testing work on refractories, and (2) to suggest and discuss problems for future research dealing with refractory materials.

The first meeting of this committee was held at the Bureau on April 24 and those attending were: C. E. Bales, Ironton Fire Brick Co., Ironton, Ohio; R. S. Bradley, A. P. Green Fire Brick Co., Mexico, Mo.; F. A. Harvey, Harbison-Walker Refractories Co., Pittsburgh Pa.; J. M. McKinley, North American Refractories Co., Cleveland, Ohio; S. M. Phelps, American Refractories Institute, Pittsburgh, Pa.; L. J. Trostel, General Refractories Co., Baltimore, Md.; and P. H. Bates and R. A. Heindl, National Bureau of Standards, Washington, D. C.

During the morning session the organization of the Bureau, its relation to the Government Departments, its contacts with the producing and consuming public and the funds available for research on refractory materials were explained in considerable detail by P. H. Bates, Chief of the Division of Clay and Silicate Products. The committee raised objections to certain

tests made in connection with the routine testing of refractory materials.

In the afternoon session the various activities of the refractories section of the Bureau were briefly described and the current investigations with the results obtained were given in some detail by the several workers engaged in the studies.

ATMOSPHERIC EXPOSURE TESTS ON NONFERROUS SCREEN-WIRE CLOTH

As described in Technical News Bulletin 215 (March 1935), the Bureau has been cooperating with Committee D-14 of the American Society for Testing Materials by conducting atmospheric-exposure tests, at 4 locations on 7 compositions of nonferrous screen wire cloth. A full report of these tests will be published as RP803 in the June number of the Journal of Research.

The materials selected by the committee were of the following nominal compositions: (1) 90 copper, 10 zinc; (2) 80 copper, 20 zinc; (3) 75 copper, 20 nickel, 5 zinc; (4) 70 nickel, 30 copper (approx.); (5) copper unalloyed; (6) 98 copper, 2 tin; (7) 95 copper, 5 aluminum.

A quantity of 16-mesh screen cloth was woven from wire of each material 0.0113 inch in diameter. The cloth was mounted in three types of frames: (1) 30- by 36-inch copper frames; (2) 30- by 36-inch wood frames; and (3) 12- by 12-inch wood frames.

The test locations selected were: (1) The Bureau of Mines at Pittsburgh, Pa., a heavy-industrial atmosphere; (2) the lighthouse depot at Portsmouth, Va., and (3) Cristobal, Canal Zone, a temperate and a tropical seacoast atmosphere, respectively, with some industrial contamination; and (4) the National Bureau of Standards, Washington, D. C., a normal inland atmosphere.

When the tests were terminated after approximately 9 years' exposure, each material had failed at Pittsburgh in one or more of the frames in the following order: Alloy (4), after 4 years; alloy (7), after 4 years, 10 months; alloy (2), after 6 years, 4 months; alloy (3), after 6 years, 11 months; and alloys (1), (6), and (5), after 7 years, 6 months. Composition (2) had failed at both Portsmouth after 4 years and at Cristobal after 4 years, 6 months; while at Washington no failures had occurred in any of the materials. The tensile strengths of the materials before and after exposure at the four stations were determined.

The results of laboratory accelerated corrosion tests previously made on the materials (salt spray and intermittent immersion tests in salt solutions and dilute acid) were not consistent with the results of the exposure tests at any of the locations and could not have been used as a prediction of the behavior of the materials in service.

ALLOYS FOR BASIC TYPES OF INGOT METALS

The Nonferrous Ingot Metal Institute is supporting at the Bureau, under the research associate plan, studies of the various alloys which may be considered as basic types for the industry.

A study has just been completed on the physical properties of red brass containing 82 percent of copper, 3 percent of tin, 5 percent of lead, and 10 percent of zinc. This alloy is considered to be on the low-copper side of the group of alloys classed by the American Society for Testing Materials as red brasses and for which the N. R. A. Code Authority has accepted as the basic alloy, the composition consisting of 85 percent of copper and 5 percent each of tin, lead, and zinc. The comparison of the physical properties of the modified alloy and the basic alloy, cast under comparable conditions, indicates the modified alloy to be superior in ductility, fluidity, and electrical conductivity, but slightly inferior in yield point and hardness, the differences in tensile strength and density being very small.

STEEL PRINTING PLATES

The Bureau is engaged in a study of work-hardening and the aging characteristics of low-carbon and medium-carbon steel plates such as are used in the mechanical transfer process of producing engraved printing plates. This work is being done in cooperation with the Bureau of Engraving and Printing of the Treasury Department. Both open-hearth and bessemer steels are included in the studies. The several steels are subjected to various degrees of cold-rolling representative of the cold-working received in the actual mechanical transfer process used in producing printing plates, and their mechanical properties are then determined. The modifications in properties resulting from cold work and aging are believed to be important factors determining that rather indefinite characteristic of carbon steel plates which the transfer press operators call "transfer quality."

ETCHING STAINLESS STEELS

All metals are composed of small imperfect crystals known as grains. The size, shape, and structure of these grains are of great importance to the metallurgist in his study of any metal and its application in service. Satisfactory revealing of grain structures is usually accomplished by etching with some suitable chemical reagent, with or without the application of an electric current. These structures may then be studied under the metallurgical microscope at suitable magnifications.

Certain of the metals are difficult to etch satisfactorily because of their composition. This is particularly true of stainless steels, because they resist attack by the ordinary reagents. Generally, it has been necessary to use strong mixed acids to reveal the structures, thus necessitating great care in handling and disposal after use.

A new method recently used at the Bureau in a study of the changes induced in stainless steels upon welding promises to be far superior to all others. This consists in etching electrolytically in oxalic acid (10 grams dissolved in 100 milliliters of water), the specimen being the anode and a piece of platinum the cathode. Current is supplied from 4 dry cells in series or from a 6-volt storage battery. Carbides are revealed in from 15 to 30 seconds' etching time, and an additional 30 to 45 seconds will reveal also the grain boundaries in the 18-8 (18 percent of Cr, 8 percent of Ni) type. The solution is relatively rapid in etching action and does not stain the specimen, a drawback of almost all other methods.

MECHANISM OF CHROMIUM DEPOSITION FROM THE CHROMIC-ACID BATH

Chromium is deposited commercially from baths composed principally of chromic acid, in which the chromium is hexavalent. After use, such baths always contain some trivalent chromium, and many of the proposed theories of this process postulate that the chromium is deposited from the trivalent (or possibly bivalent) state, for which the chromic acid serves as a reservoir.

In RP797 in the *Journal of Research* for June, evidence is presented to show that chromium is deposited directly from the hexavalent state. The principal evidence is the fact that relatively large additions of compounds of metals such as zinc, nickel, cadmium,

iron, and copper have no such effects upon the behavior of the chromic-acid bath as would be expected if deposition occurred from the trivalent state. It is shown by cryoscopic and spectrophotometric data that the dichromates of these metals are strongly ionized.

The low efficiency and high polarization in chromium deposition are accounted for, and certain paradoxes are explained in this paper. Although possible directions for improvement are pointed out, none of them appears practicable with existing knowledge.

SEPARATION OF THE SIX PLATINUM METALS FROM ONE ANOTHER AND THEIR GRAVIMETRIC DETERMINATION

At the meeting of the division of physical and inorganic chemistry of the American Chemical Society in New York on April 25, a paper on the separation of the platinum metals and their gravimetric determination was presented by Dr. Raleigh Gilchrist. The following is an abstract of this paper:

A detailed procedure has been developed at the Bureau by which the six platinum metals can be quantitatively separated from one another and determined gravimetrically.

In this system of analysis, precipitation with ammonium chloride, fusion with pyrosulphate, and extraction of metallic mixtures with acids are avoided entirely. Other departures from the usual procedures are as follows: Collecting osmium in hydrochloric acid containing sulphur dioxide, instead of in an alkaline solution; distilling ruthenium from an acid solution, in the presence of sodium bromate, and collecting it in hydrochloric acid containing sulphur dioxide; determining osmium and also ruthenium by precipitating their respective hydroxides from solutions originally acid; separating platinum from palladium, rhodium, and iridium, by precipitating the hydroxides of the three last-named metals under conditions of controlled hydrolysis; separating rhodium from iridium by reducing the former metal with titanous chloride, together with a technic for preparing the precipitated metallic rhodium for the necessary reprecipitation; determining iridium by precipitation and direct ignition of its hydroxide.

The reagents employed are generally available, and no unusual equipment is required. While the operations must be performed carefully, they do not involve technic unfamiliar to a trained analyst.

The six platinum metals are separated from one another in the following order: Osmium, ruthenium, platinum, palladium, rhodium, iridium.

(a) *Separation and determination of osmium.*—Osmium is removed first by forming its tetroxide in a solution of the 6 platinum metals containing 10 percent of nitric acid by volume. The apparatus used consists of a 700-ml distilling flask, a set of three 300-ml absorbing flasks, and a train of inlet and delivery tubes which are sealed into one piece. The flasks are attached to the apparatus by means of ground joints. The tetroxide is swept from the boiling solution by a gentle current of air and absorbed in 6 normal hydrochloric acid saturated with sulphur dioxide. The absorbent solutions are combined and evaporated to a sirup on the steam bath. The sirupy residue is digested with concentrated hydrochloric acid and evaporated. This operation is repeated several times to ensure complete decomposition of sulphite compounds of osmium. The osmium solution is finally diluted to 150 ml, heated to boiling, and its acidity reduced by the addition of sodium bicarbonate until a value of pH 4 is reached, as indicated by bromophenol blue. The solution is boiled for 5 to 6 minutes to ensure complete precipitation. The hydrated dioxide of osmium is caught on a Munroe platinum crucible, washed well with a hot 1 percent solution of ammonium chloride, impregnated with saturated ammonium chloride, dried by suction, and ignited to metal under hydrogen. The hydrogen atmosphere is finally displaced with carbon dioxide. The residue is weighed as metallic osmium.

(b) *Separation and determination of ruthenium.*—The solution in the distilling flask, after the removal of osmium, is evaporated on the steam bath to eliminate nitric acid. It is then evaporated several times with concentrated hydrochloric acid to expel oxides of nitrogen. The resulting solution is diluted somewhat, 10 ml of concentrated sulphuric acid is added, and this solution heated until vapors of sulphuric acid are evolved. The sulphate solution, together with any metallic platinum, is returned to the distilling flask and diluted to about 100 ml. Ruthenium as tetroxide is eliminated from the boiling solution by the addition of sodium bromate. The tetroxide is absorbed in hydrochloric acid saturated with sulphur dioxide, in the same manner and in the same apparatus that was used for osmium.

The ruthenium is recovered from the evaporated absorbent solution in a manner similar to that used for recovering osmium, except that the precipitation is made at pH 6, using broccresol purple indicator. The precipitate is caught on filter paper, washed with a hot 1 percent solution of ammonium sulphate, then with a cold 2.5 percent solution of the same reagent, ignited to an anhydrous oxide, reduced in hydrogen, and finally weighed as metallic ruthenium.

(c) *Separation and determination of platinum.*—The simplest and most direct way to separate platinum from palladium, rhodium, and iridium is to precipitate collectively by hydrolysis the hydrated oxides of palladium, rhodium, and iridium.

The solution in the distilling flask, after the elimination of ruthenium, is prepared for the precipitation of palladium, rhodium, and iridium. The hydrated oxides of these three metals are completely precipitated by hydrolysis at pH 6 in a boiling solution containing sodium bromate. In order to ensure the complete elimination of platinum, the precipitate of hydrated oxides is dissolved in hydrochloric acid and the above precipitation repeated.

The platinum is recovered by hydrogen from the filtrates of the above precipitations, after destruction of residual bromate. In extremely careful work, the ignited sulphide is redissolved and the platinum again precipitated, this time by formic acid in a solution buffered with sodium acetate. The precipitated metal is ignited and weighed as metallic platinum.

(d) *Separation and determination of palladium.*—Palladium is separated from a solution of the hydrolytic precipitate of palladium, rhodium, and iridium in hydrochloric acid by means of dimethylglyoxime. A single precipitation appears to effect a clean separation of palladium from rhodium and iridium. The palladium is determined either as the glyoxime compound, using the theoretical factor 0.3167, or as metal. When determined as metal, the glyoxime precipitate is caught on paper, ignited in air, reduced in hydrogen, ignited in carbon dioxide, and cooled in this gas.

(e) *Separation and determination of rhodium.*—The filtrate from the precipitation of palladium is evaporated with 10 ml of sulphuric acid. Organic matter is destroyed by the addition of nitric acid. The solution is heated to vapors of sulphuric acid in order to convert the two metals to sulphates. The solution is diluted to 200 ml,

heated to boiling, and the rhodium precipitated as metal by adding titanous chloride in slight excess. The precipitated metal is dissolved in boiling sulphuric acid and the precipitation repeated to ensure complete removal of iridium. The metallic rhodium is again dissolved in sulphuric acid, and the resulting solution converted to a rose-colored solution by heating with hydrochloric acid. The rhodium is recovered by hydrogen sulphide, ignited in air, reduced in hydrogen, and weighed as metallic rhodium.

(f) *Recovery and determination of iridium.*—Iridium is recovered from the filtrates of the titanous chloride precipitations of rhodium, by hydrolytic precipitation at pH 6 in the presence of bromate, after the removal of titanium by cupferron. It is weighed as metallic iridium.

An alternative procedure for the determination of iridium consists in determining rhodium and iridium together as a metallic mixture in an aliquot portion of the solution containing these two metals. In this way, the cupferron precipitations are avoided. Rhodium must be determined independently in another aliquot portion in the manner outlined above.

In the development of the foregoing procedure, it was found that under the conditions established for distilling osmium tetroxide, and also for distilling ruthenium tetroxide, none of the other platinum metals, except the one being distilled, appeared in the absorbing solution. In the separation of platinum, palladium, rhodium, and iridium from one another, each of these metals was isolated without significant contamination by the other three metals. The errors observed in the determination of the recovered metals ranged from -0.2 to $+0.2$ mg, and averaged within 0.1 mg of the quantities taken, which, in the experimental work, varied from 100 to 300 milligrams.

APPARATUS FOR MEASURING BOILING POINTS

Research Paper RP796 in the June number of the Journal of Research, describes an apparatus suitable for determining accurately the boiling point of lubricating oils and other compounds of high molecular weight at temperatures and pressures below their decomposition points. The temperatures are determined by means of three thermocouples located at different heights in the vapor column, which give by their differences in temperature

some indication of the purity of the sample, the readings of the three thermocouples being identical for a pure substance. The pressures are determined with a McLeod gage.

Data are reported for pure di-*n*-butyl phthalate, for mixtures of di-*n*-butyl phthalate with 6.82, 10.62, and 18.75 mole percent of tri-*n*-cresyl phosphate, and for two lubricating oil fractions obtained from successive distillations.

SELECTIVE ADSORPTION FROM SOAP SOLUTIONS

The existence of an acid soap resulting from the hydrolysis of soap in dilute aqueous solution has been suggested by different investigators. There is considerable evidence to show that the principal surface-active constituent of a soap solution, to which is attributed its efficiency as a lubricant, detergent, and emulsifying agent, is the acid soap. This view is consistent with the fact that the addition of alkali to a neutral soap solution raises the surface tension and decreases the effectiveness of the soap in the processes mentioned, while the addition of fatty acid often improves the emulsifying and lubricating ability of the soap solution.

If the acid soap is the surface-active agent in the solution, it will concentrate at the interfaces and the aqueous medium will become more alkaline, unless the material forming the interface with the soap solution is acidic in nature or strongly adsorbs hydroxyl ions.

It was the purpose of a research described in RP801 in the June number of the Journal of Research, to study the selective adsorption at various types of interfaces formed by soap solutions in contact with different materials.

Soap is adsorbed from aqueous solution at all types of interfaces, but the ratio of fatty acid to alkali in the adsorbed portion varies with the nature of the interface.

Soap foam, continuously removed from an aqueous solution by CO_2 -free air, was found to be less alkaline than the original solution, while the latter became progressively more alkaline. The addition of alkalies to the soap solution decreased the selective effect and modified the character of the foam.

When carbon black, paraffin oil, and pure olive oil were brought in contact with soap solutions, the aqueous medium became more alkaline and acid soap was adsorbed at the interface.

Fuller's earth, olive oil containing free fatty acid, wool, and silk in soap solutions adsorbed soap and alkali at the interface and the aqueous medium became more acid. Cotton showed no selective adsorption and adsorbed a relatively small amount of soap.

ANTIOXIDANTS IN RUBBER

The Bureau has recently completed a study of antioxidants in rubber which was initiated in 1926 when these materials were coming into general use in the manufacture of rubber products. At that time, opinions as to the value of antioxidants were based largely on accelerated aging tests of short duration, so it seemed desirable to compare the results of such tests with the results which were obtained when rubber was exposed to the weather or kept in storage for relatively long periods of time.

RP795 in the June number of the Journal of Research presents the results obtained when five commercial antioxidants were tested in a series of different rubber compounds under the following conditions: (1) Storage in the dark, (2) exposure to the weather, (3) to air at 70° C, (4) to air at 90° C, and (5) to oxygen at 60° C at a pressure of 300 lb/in². As a measure of the rate of deterioration, tensile-strength tests were made at appropriate intervals over periods of exposure which ranged from a few days in the case of the tests in air at 90° C to 7 or 8 years in the case of samples stored in the dark.

The results indicate that the use of antioxidants in rubber is advantageous under all conditions and that the increase in the life of the rubber may vary from a few percent to twofold or even threefold, depending upon the type of rubber compound, the conditions under which it is used, and the particular antioxidant employed. Furthermore, since the effectiveness of any given antioxidant varies with the conditions to which the rubber is exposed, it is not possible to rate the different antioxidants in any order of merit.

Since the data are complex, two means are suggested for expressing the effectiveness of antioxidants numerically: First, a *time index* which is a measure of the increase in time during which a rubber compound will remain serviceable; and second, a *tensile index* which is a measure of the improvement in the average tensile strength when compared with samples containing no antioxidant. By a tabulation of these indexes, the behavior of antioxi-

dants under a wide variety of circumstances can be presented in concise form.

COTTON-RAG PAPERS

The stability of paper is of particular significance in the preservation of valuable records. Quite often records of perpetual value have been placed on impermanent papers because it was impossible to foretell the probable life span of the paper. The purpose of a recent study at the Bureau (described in RP794 in the June number of the Journal of Research) was to obtain information on the causes of deterioration as related to the papermaking materials and processes used for writing papers prepared from rags.

The fact that paper is resistant to deterioration from internal causes is not sufficient to insure its permanence. The conditions of its use and storage are as important as the initial quality of the paper, but these factors have been discussed in other Bureau publications.

The basic constituent of paper is fibrous cellulose. Cellulose in the pure state is a very stable material, but it is susceptible to deterioration by chemical changes when associated with certain impurities. The degree of stability of paper is dependent on the purity of the paper in respect to active chemical components, the presence of which may be due to insufficient purification of the fiber or to other deteriorative agents produced or left within the paper by the method of manufacture.

High-grade bond papers were made from new and old rags in the Bureau's semicommercial mill under controlled conditions. Unsized, engine-sized, and surface-sized papers were included. For most of the beater sizing, rosin size was used, being precipitated on the fibers in the usual way with paper-makers' alum.

The basic rags, the half-stuffs made from them, and the finished papers were analyzed. The papers were tested for strength and chemical purity, and the degree of retention of the initial strength and of the desirable chemical properties was also determined after the paper had been subjected to an accelerated aging test, made by heating the paper for 72 hours at 100° C.

The data obtained confirm the general belief that high acidity resulting from excessive use of alum in rosin sizing has a marked deteriorating effect upon paper. The pH value for

optimum results as far as stability is concerned was approximately 5.0. The degree of sizing at this acidity was also satisfactory.

Of papers of the same acidity, those having the lesser content of rosin were the more stable.

In general, surface sizing did not materially affect the life of base papers of high stability, although it seemed to serve as a protective surface retarding chemical deterioration of the less stable papers.

Initial quality of the fibrous raw material cannot be taken as a criterion of the degree of excellence of paper made therefrom. The study shows that careful processing of raw materials in respect of chemically active components is necessary for the manufacture of stable papers.

SWEETPOTATO STARCH FOR THE BEATER SIZING OF PAPER

Referring to an item on this subject in Technical News Bulletin 211 (November 1934), the Bureau is now definitely of the opinion that an excellent starch for sizing printing papers can be made from cull sweetpotatoes. This conclusion is based on the results of recent experiments at the Bureau, on starch produced by scientists at the United States Department of Agriculture. The profitable utilization of at least a part of this farm waste in the domestic paper industry would mean increased income for the farmer.

Corn and cassava starches, the latter an imported product, are widely used as beater sizings in book and catalog papers to improve printing quality. The suitability of the sweetpotato product for this purpose was appraised by making, in the Bureau's experimental paper mill, a series of book papers in which the sweetpotato starch was used in comparison with representative commercial sizing starches made from corn and cassava. The results obtained with sweetpotato starch were equal to the best results obtained with the other starches with respect to strength and opacity of the papers, and superior with respect to retention of mineral filler, and "closing the sheet", as indicated by air permeability. Hence, the starch from cull sweetpotatoes is apparently a high-grade material for beater sizing, at least equal in quality to the best commercial starches commonly used for the purpose.

EFFECT OF SULPHURIC ACID ON CHROME-TANNED LEATHER

It has been found at the Bureau that the strength of chrome-tanned leather

is much less affected by the addition of sulphuric acid than is the strength of vegetable-tanned leather. This result is given in RP802 in the June number of the Journal of Research.

The greater amount of all leather products are tanned either by the vegetable process, in which the natural tannins extracted from wood or bark are used as the tanning agent, or by a chemical process, in which a basic salt of chromium is used as the tanning material. Recent investigations at the Bureau have indicated the limit of safety for sulphuric-acid content, beyond which vegetable-tanned leathers are seriously affected, when aged for 2 years. Little has been known about the effect of sulphuric acid on the tensile strength of chrome-tanned leather. This leather contains a definite amount of acid when tanned and the relation of acid to chromium content influences some of the properties of the finished product.

Fibrous materials such as leather may absorb sulphur dioxide, in the form of sulphuric acid, from polluted atmospheres. Since chrome-tanned leather has been shown to have greater resistance to the deteriorating effect of added sulphuric acid than vegetable-tanned leather, it might be expected to give longer service in atmospheres containing sulphur dioxide.

MEASUREMENT OF SOUND TRANSMISSION

RP800 in the June number of the Journal of Research gives a description of the equipment and method now used in making sound-transmission measurements at the Bureau. The method of measurement is essentially the same as that described in an earlier paper, but the equipment has been improved in line with developments in amplifier circuits, loud speakers, and microphones.

To determine the transmission of sound through the test panel it is necessary to know the average sound pressure in the immediate vicinity of the panel. To make the sound pressure as uniform as possible a revolving loud speaker is used as a moving source, and the frequency is varied through a certain range to give a "warble note" and hence a continuously shifting interference pattern. A thermoclement is used as an integrating device to give the average sound pressure. Measurements are taken at a number of points on each side of the panel at nine frequency bands covering a range from 128 to 4,096 cycles per second.

The results of sound transmission measurements on a number of floor and wall panels are given. Results on the transmission of impact noises are also given for the floor panels, and there is a brief discussion of methods of reducing this type of noise.

Specifications for the construction of the various panels are appended.

STANDARD TIME THROUGHOUT THE WORLD

The rapid development of modern means of national and international communication has brought about a greater realization of the difference in time between different geographic centers. To answer the many demands for information on standard time, the Bureau several years ago published a pamphlet entitled *Standard Time Throughout the World*, the latest revision of which has just been issued under the designation Circular C406. This circular gives a brief historical sketch of the development of the standard time system, time-zone maps of the United States and of the world, a list of stations transmitting radio time signals, a list of the times used in several large cities, a list of the legal times used in most of the countries of the world, and other information regarding standard time.

Copies of this publication are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

NEW AND REVISED PUBLICATIONS ISSUED DURING MAY 1935

Journal of Research¹

Journal of Research of the National Bureau of Standards, vo. 14, no. 5, May 1935 (RP784 to 793, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers¹

[Reprints from the January, February, and March 1935 Journal of Research]

RP758. Moisture relations of aircraft fabrics. G. M. Kline. Price 5 cents.

RP759. The national primary standard of radio frequency. E. L. Hall, V. E. Heaton, and E. G. Lapham. Price 5 cents.

¹ Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to *Technical News Bulletin*, 50 cents per year; *Journal of Research*, \$2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries, 70 cents and \$3.25, respectively.

RP760. Specific volume, compressibility, and volume thermal expansivity of rubber-sulphur compounds. A. H. Scott. Price 5 cents.

RP761. Influence of magnesium sulphate on the deterioration of vegetable-tanned leather by sulphuric acid. R. C. Bowker, E. L. Wallace, and J. R. Kanagy. Price 5 cents.

RP763. Impact and static tensile properties of bolts. H. L. Whittemore, G. W. Nusbaum, and E. O. Seaquist. Price 10 cents.

RP764. A method for determining stresses in a nonrotating propeller blade vibrating with a natural frequency. W. Ramberg, P. S. Ballif, and M. J. West. Price 5 cents.

RP765. Combining weight of collagen. J. Beek, Jr. Price 5 cents.

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